FIG.1

1	2	3	4	5
COLOR-SPACE CONVERSION/ INVERSE CONVERSION PART	TWO-DIMENSIONAL WAVELET TRANSFORM/ INVERSE TRANSFORM PART	QUANTIZATION/ INVERSE QUANTIZATION PART	ENTROPY ENCODING/ DECODING PART	TAG PROCESSING PART

IMAGE

CODE STREAM

COMPRESS →

DECOMPRESS →

FIG.2

ORIGINAL RGB
IMAGE
(S1)

COLOR
CONVERSION
(S2)

WAVELET
TRANSFORM
(S3)

PROGRESSIVE
SUB-BIT-PLANE
CODING
(S4)

ENTROPY
CODING
(S5)

FIG.3A

6₀

0LL (ORIGINAL IMAGE TILE)

DECOMPOSITION_LEVEL_0

FIG.3B

6₁

1LL	1HL
1LH	1HH
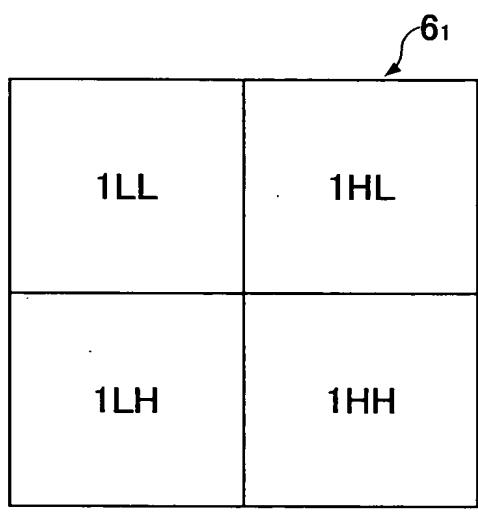
DECOMPOSITION_LEVEL_1

FIG.3C

6₂
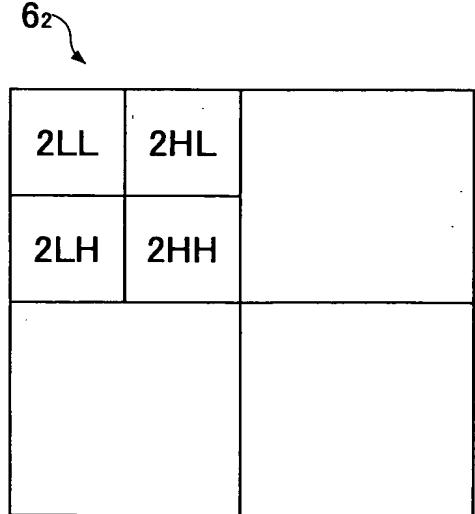
2LL	2HL	
2LH	2HH	

DECOMPOSITION_LEVEL_2

FIG.3D

6₃

3LL 3HL

3LH

3HH

DECOMPOSITION_LEVEL_3

FIG.4

7_B

B COMPONENT
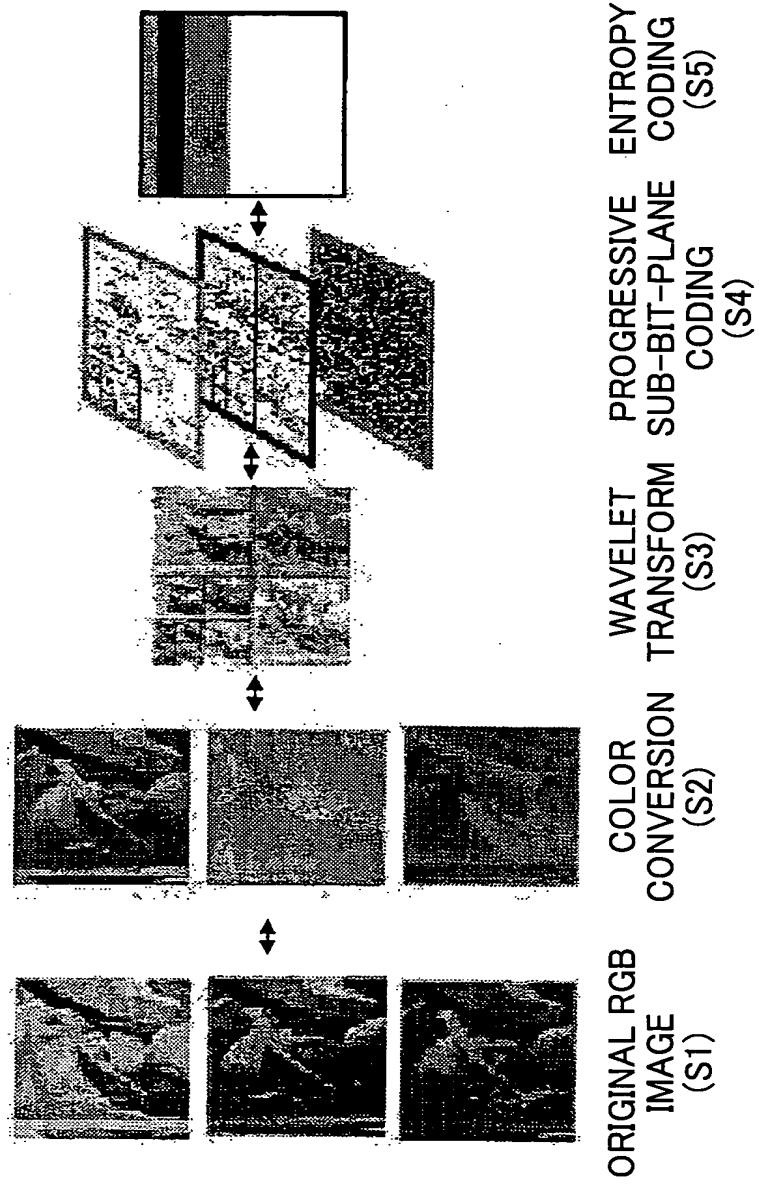
B00	B01	B02	B03
B04	B05	B06	
B08	B09	B10	
B12	B13	B14	

7_{Bt}

7_G

G COMPONENT

G00	G01	G02	G03
G04	G05	G06	
G08	G09	G10	
G12	G13	G14	

7_{Gt}

7_R

R COMPONENT

R00	R01	R02	R03
R04	R05	R06	R07
R08	R09	R10	R11
R12	R13	R14	R15

7_{Rt}

FIG.5

FIG.6

The figure is a bit-plane / coding-order chart (rotated on the page). The top headers give the SUB-BAND and PRECINCT No.; the left side lists the BIT PLANE (from MSB "Code Of Bit 12" down to LSB "Code Of Bit 1"), each divided into the sub-bit planes **Significant / Refinement / Cleanup**. The cell values are the coding-order numbers (0–228).

SUB-BAND	PRECINCT No.	Bit 12 (MSB)	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1 (LSB)
1HH	51			72	93	114	135	156	177	198	215	228	
1HH	50			71	92	113	134	155	176	197	214	227	
1HH	49			70	91	112	133	154	175	196	213	226	
1HH	48			69	90	111	132	153	174	195	212	225	
1HH	47			68	89	110	131	152	173	194	211	224	
1HH	46			67	88	109	130	151	172	193	210	223	
1HH	45			66	87	108	129	150	171	192	209	222	
1HH	44			65	86	107	128	149	170	191	208	221	
1HH	43			64	85	106	127	148	169	190	207	220	
1LH	42			72	93	114	135	156	177	198	215	228	
1LH	41			71	92	113	134	155	176	197	214	227	
1LH	40			70	91	112	133	154	175	196	213	226	
1LH	39			69	90	111	132	153	174	195	212	225	
1LH	38			68	89	110	131	152	173	194	211	224	
1LH	37			67	88	109	130	151	172	193	210	223	
1LH	36			66	87	108	129	150	171	192	209	222	
1LH	35			65	86	107	128	149	170	191	208	221	
1LH	34			64	85	106	127	148	169	190	207	220	
1HL	33			72	93	114	135	156	177	198	215	228	
1HL	32			71	92	113	134	155	176	197	214	227	
1HL	31			70	91	112	133	154	175	196	213	226	
1HL	30			69	90	111	132	153	174	195	212	225	
1HL	29			68	89	110	131	152	173	194	211	224	
1HL	28			67	88	109	130	151	172	193	210	223	
1HL	27			66	87	108	129	150	171	192	209	222	
1HL	26			65	86	107	128	149	170	191	208	221	
1HL	25			64	85	106	127	148	169	190	207	220	
2HH	7			15	63	84	105	126	147	168	189	206	219
2HH	6			14	62	83	104	125	146	167	188	205	218
2HH	5			13	61	82	103	124	145	166	187	204	217
2HH	4			12	60	81	102	123	144	165	186	203	216
2LH	7			15	23	59	80	101	122	143	164	185	202
2LH	6			14	22	58	79	100	121	142	163	184	201
2LH	5			13	21	57	78	99	120	141	162	183	200
2LH	4			12	20	56	77	98	119	140	161	182	199
2HL	7			15	63	59	80	101	122	143	164	185	202
2HL	6			14	62	58	79	100	121	142	163	184	201
2HL	5			13	61	57	78	99	120	141	162	183	200
2HL	4			12	20	56	77	98	119	140	161	182	190
2LL	3			11	19	27	55	76	97	118	139	160	181
2LL	2			10	18	26	54	75	96	117	138	159	180
2LL	1			9	17	25	53	74	95	116	137	158	179
2LL	0			8	16	24	52	73	94	115	136	157	178

FIG.7

SUB-BAND	2LL	2HL	2LH	2HH	1HL	1LH	1HH
PRECINCT No.	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3 4 5 6 7 8	0 1 2 3 4 5 6 7 8	0 1 2 3 4 5 6 7 8

BIT PLANE / SUB-BIT PLANE (left axis, top MSB → bottom LSB):

- MSB
- Code Of Bit 12 — Cleanup
- Code Of Bit 11 — Significant / Refinement / Cleanup
- Code Of Bit 10 — Significant / Refinement / Cleanup
- Code Of Bit 9 — Significant / Refinement / Cleanup
- Code Of Bit 8 — Significant / Refinement / Cleanup
- Code Of Bit 7 — Significant / Refinement / Cleanup
- Code Of Bit 6 — Significant / Refinement / Cleanup
- Code Of Bit 5 — Significant / Refinement / Cleanup
- Code Of Bit 4 — Significant / Refinement / Cleanup
- Code Of Bit 3 — Significant / Refinement / Cleanup
- Code Of Bit 2 — Significant / Refinement / Cleanup
- Code Of Bit 1 — Significant / Refinement / Cleanup
- LSB

Data grid (Precinct No. followed by code order numbers):

Precinct No.									
51	72	93	114	135	156	177	198	215	228
50	71	92	113	134	155	176	197	214	227
49	70	91	112	133	154	175	196	213	226
48	69	90	111	132	153	174	195	212	225
47	68	89	110	131	152	173	194	211	224
46	67	88	109	130	151	172	193	210	223
45	66	87	108	129	150	171	192	209	222
44	65	86	107	128	149	170	191	208	221
43	64	85	106	127	148	169	190	207	220
42	72	93	114	135	156	177	198	215	228
41	71	92	113	134	155	176	197	214	227
40	70	91	112	133	154	175	196	213	226
39	69	90	111	132	153	174	195	212	225
38	68	89	110	131	152	173	194	211	224
37	67	88	109	130	151	172	193	210	223
36	66	87	108	129	150	171	192	209	222
35	65	86	107	128	149	170	191	208	221
34	64	85	106	127	148	169	190	207	220
33	72	93	114	135	156	177	198	215	228
32	71	92	113	134	155	176	197	214	227
31	70	91	112	133	154	175	196	213	226
30	69	90	111	132	153	174	195	212	225
29	68	89	110	131	152	173	194	211	224
28	67	88	109	130	151	172	193	210	223
27	66	87	108	129	150	171	192	209	222
26	65	86	107	128	149	170	191	208	221
25	64	85	106	127	148	169	190	207	220
7	15	63	84	105	126	147	168	189	206	219
6	14	62	83	104	125	146	167	188	205	218
5	13	61	82	103	124	145	166	187	204	217
4	12	60	81	102	123	144	165	186	203	216
7	15	23	59	80	101	122	143	164	185	202
6	14	22	58	79	100	121	142	163	184	201
5	13	21	57	78	99	120	141	162	183	200
4	12	20	56	77	98	119	140	161	182	199
7	15	63	59	80	101	122	143	164	185	202
6	14	62	58	79	100	121	142	163	184	201
5	13	61	57	78	99	120	141	162	183	200
4	12	20	56	77	98	119	140	161	182	190
3	11	19	27	55	76	97	118	139	160	181
2	10	18	26	54	75	96	117	138	159	180
1	9	17	25	53	74	95	116	137	158	179
0	8	16	24	52	73	94	115	136	157	178

Legend:

- LAYER 0
- LAYER 1
- LAYER 2
- LAYER 3
- LAYER 4
- LAYER 5
- LAYER 6
- LAYER 7
- LAYER 8
- LAYER 9

- THUMBNAIL FOR DIGITAL CAMERA
- THUMBNAIL FOR IMAGE VIEWER SOFTWARE
- 2LL — THUMBNAIL FOR MOBILE PHONE

FIG.8

SUB-BAND	2LL	2HL	2LH	2HH	1HL	1LH	1HH
PRECINCT No.	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3 4 5 6 7 8	0 1 2 3 4 5 6 7 8	0 1 2 3 4 5 6 7 8

BIT PLANE	SUB-BIT PLANE							
MSB								
Code Of Bit 12	Significant Refinement Cleanup					51		
Code Of Bit 11						50	71 92 113	134 155 176 197 214 227
Code Of Bit 10	Significant Refinement Cleanup					49 70 91 112	133 154 175 196 213 226	
Code Of Bit 9	Significant Refinement Cleanup							
Code Of Bit 8	Significant Refinement Cleanup							
Code Of Bit 7	Significant Refinement Cleanup							
Code Of Bit 6	Significant Refinement Cleanup							
Code Of Bit 5	Significant Refinement Cleanup							
Code Of Bit 4	Significant Refinement Cleanup							
Code Of Bit 3	Significant Refinement Cleanup							
Code Of Bit 2	Significant Refinement Cleanup							
Code Of Bit 1	Significant Refinement Cleanup							
LSB								

Legend:

- LAYER 0
- LAYER 1
- LAYER 2
- LAYER 3
- LAYER 4
- LAYER 5
- LAYER 6
- LAYER 7
- LAYER 8
- LAYER 9
- LAYER 10
- LAYER 11
- LAYER 12

FIG.9

FIG.10

FIG.11

JP2 FILE

JPEG2000 SIGNATURE BOX
FILE TYPE BOX

JP2 HEADER BOX (SUPER BOX)

IMAGE HEADER BOX
BITS PER COMPONENT BOX
COLOR SPECIFICATION BOX (0)

⋮

COLOR SPECIFICATION BOX (n)
PALETTE BOX
COMPONENT MAPPING BOX
CHANNEL DEFINITION BOX

RESOLUTION BOX (SUPER BOX)

CAPTURE RESOLUTION BOX
DEFAULT DISPLAY RESOLUTION BOX

CONTIGUOUS CODESTREAM BOX (0)

⋮

CONTIGUOUS CODESTREAM BOX (m−1)

IPR BOX
XML BOXES
UUID BOXES

UUID INFO BOXES (SUPER BOX)

UUID LIST BOX
DATA ENTRY URL BOX

FIG.12

IMAGE PROCESSING APPARATUS
(IMAGE COMPRESSION APPARATUS) ⟋20

IMAGE
DATA

⟋21
IMAGE
READING
PART

⟋22
IMAGE QUALITY
DIVIDING
PART

⟋23
CODE SIZE
COMPUTING
PART

⟋24
CODE SIZE
RECORDING PART
(CODE SIZE
EMBEDDING PART)

FIG.13

START

S11 —— READ IMAGE

S12 —— DIVIDE INTO
IMAGE QUALITY LEVELS

S13 —— COMPUTE CODE SIZE OF
EACH IMAGE QUALITY LEVEL

S14 —— RECORD CODE SIZE OF
EACH IMAGE QUALITY LEVEL

END

FIG.14

CAPACITY OF TRANSMISSION LINE (bps)	IMAGE QUALITY LEVEL
1G	LAYER 0
100M	LAYER 2
10M	LAYER 4
8M	LAYER 5
1M	LAYER 7
5.6K	LAYER 10

FIG.15

IMAGE PROCESSING APPARATUS
(IMAGE COMPRESSION APPARATUS)
220

IMAGE DATA →

| IMAGE READING PART (221) | CODE SIZE SETTING PART (225) | IMAGE QUALITY LEVEL COMPUTING PART (226) |

| IMAGE QUALITY DIVIDING PART (222) | CODE SIZE COMPUTING PART (223) | CODE SIZE RECORDING PART (CODE SIZE EMBEDDING PART) (224) |

FIG.16

START

S21 — READ IMAGE

S22 — SET CODE SIZE

S23 — COMPUTE
IMAGE QUALITY LEVEL

S24 — DIVIDE INTO
IMAGE QUALITY LEVELS

S25 — COMPUTE CODE SIZE OF
EACH IMAGE QUALITY LEVEL

S26 — RECORD
CORRESPONDING RELATION

END

FIG.17

320

IMAGE PROCESSING APPARATUS
(IMAGE COMPRESSION APPARATUS)

IMAGE DATA →

321
IMAGE
READING
PART

327
DESIRED-CODE
SIZE SETTING
PART

328
CODE SIZE
MODIFYING
PART

322
IMAGE QUALITY
DIVIDING
PART

323
CODE SIZE
COMPUTING
PART

324
CODE SIZE
RECORDING
PART

FIG.18

START

S31 — READ IMAGE

S32 — DIVIDE INTO
IMAGE QUALITY LEVELS

S33 — COMPUTE CODE SIZE OF
EACH IMAGE QUALITY LEVEL

S34 — RECORD CODE SIZE OF
EACH IMAGE QUALITY LEVEL

S35 — MODIFY COMPRESSED
CODE DATA BASED ON
DESIRED CODE SIZE

END

FIG.19

FIG.20

```
                      ┌─────────────┐
                      │    START    │
                      └─────────────┘
                             │
                             ▼
S41 ─────┌──────────────────────────────────┐
         │            READ IMAGE             │
         └──────────────────────────────────┘
                             │
                             ▼
S42 ─────┌──────────────────────────────────┐
         │            DIVIDE INTO            │
         │       IMAGE QUALITY LEVELS        │
         └──────────────────────────────────┘
                             │
                             ▼
S43 ─────┌──────────────────────────────────┐
         │        COMPUTE CODE SIZE OF       │
         │      EACH IMAGE QUALITY LEVEL     │
         └──────────────────────────────────┘
                             │
                             ▼
S44 ─────┌──────────────────────────────────┐
         │        RECORD CODE SIZE OF        │
         │      EACH IMAGE QUALITY LEVEL     │
         └──────────────────────────────────┘
                             │
                             ▼
S45              ╱─────────────────╲        NO
            ╱─────  REQUEST FOR  ─────╲──────────┐
            ╲   SETTING DESIRED      ╱           │
             ╲    CODE SIZE?       ╱             │
              ╲─────────────────╱                │
                       │ YES                     │
                       ▼                         │
S46 ─────┌──────────────────────────────────┐    │
         │       SET DESIRED CODE SIZE       │    │
         └──────────────────────────────────┘    │
                       │                         │
                       ▼                         │
S47 ─────┌──────────────────────────────────┐    │
         │             COMPUTE              │    │
         │       TRUNCATION LOCATION        │    │
         └──────────────────────────────────┘    │
                       │                         │
                       ▼                         │
S48 ─────┌──────────────────────────────────┐    │
         │    RECORD TRUNCATION LOCATION    │    │
         └──────────────────────────────────┘    │
                       │                         │
                       ▼◄────────────────────────┘
                 ┌─────────────┐
                 │     END     │
                 └─────────────┘
```

FIG.21

FIG.22A

FIG.22B

FIG.22C

FIG.22D

FIG.23

CORRESPONDING
RELATION DATA

RAM

51

CPU

52

iv

READ
IMAGE DATA

iii

ii

53

DATA BUS

i

54

IMAGE DATA

HDD

CORRESPONDING
RELATION DATA